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(71) Applicant *(for all designated States except US):* PRUTEC LIMITED [GB/GB]; 142 Holborn Bars, London EC1N 2NH. (GB).

(72) Inventor; and
(75) Inventor/Applicant *(for US only) :* LEWIS, Creighton, Martin, Cecil [GB/GB]; Oakfield, Llanbadoch, Usk, Gwent NP5 1TG (GB).

(74) Agent: MESSULAM, Moses, Alec; A. Messulam & Co., 24, Broadway, Leigh on Sea, Essex SS9 1BN. (GB).

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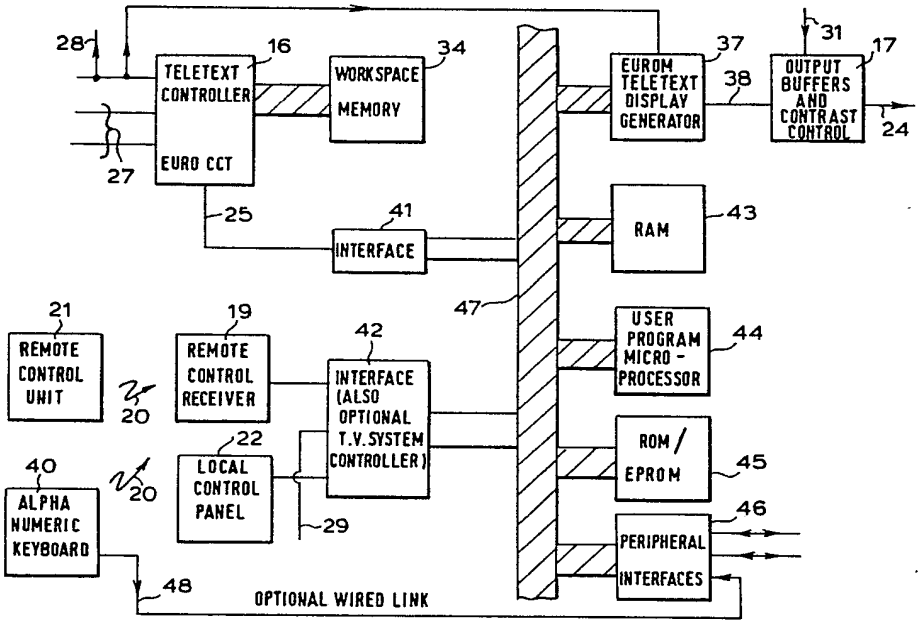

(57) Abstract

A television receiver including Teletext decoder and display circuitry and a user programmable computer which comprises a processor connected to communicate with the Teletext display circuit and with the display memory of the Teletext circuitry. The invention provides the user of greater freedom in manipulation of data received by Teletext and also permits an inexpensive realisation of a computer by enabling several circuits to be shared between the computer and the Teletext circuits.

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INFORMATION PROCESSING APPARATUS

The present invention is concerned with a combined television broadcast receiver and a user programmable computer.

A broadcast television signal generally consists of both a video signal and an audio signal, each modulated onto a radio frequency carrier. The video signal contains the picture of information used to convey brightness and colour information and synchronising information to permit the receiver to reconstruct the transmitted picture and display it. The audio signal contains the audio channel associated with the picture and any synchronising information associated with it, for example, for decoding a stereo audio transmission for output to two loudspeakers.

The block diagram of a simple colour television receiver is shown in Figure 1. The required television channel containing a video signal and its associated audio signal is selected by the viewer on the channel selector 2, which generates a control voltage to cause the tuner 1 to select the required signal from all those received by the aerial 3 and to convert the selected signals to fixed I.F. frequencies (intermediate frequencies) for amplification by the amplifier incorporated in the amplifier and detector module 4. The detector portion of the module 4 recovers the baseband video signal and also recovers the audio signal still in modulated form.

The audio signal recovered by the detector 4 is further amplified and the baseband audio signal is recovered in the sound intermediate frequency amplifier and detector module 5. The baseband audio signal is then further amplified in the audio amplifier 6 and fed to the loudspeaker 7.

The baseband video signal is fed to a synchronising pulse separator 10 which recovers the timing information used to position the electron beam in the correct position on the cathode ray tube (C.R.T.) screen 13. Deflection of the beam occurs by the action of a line timebase 11 and frame timebase 12 which drive deflection coils 14 placed around the neck of the tube 13.

The line timebase 11 also produces various timing signals to assist other modules 8 and 9 to produce good quality video signals, but this will not be described in detail as it is not relevant to the present invention.

The baseband video signal from the detector 4 is also applied to a colour decoder module 8 which recovers from the one video signal the colour difference signals and the analogue luminance signal, the latter corresponding to the video signal displayed by a black and white television receiver. The colour and luminance signals are processed to generate three separate signals for the red, green and blue guns of the tube, respectively, these signals being amplified in the video amplifiers 9 and used to modulate the three electron beams in the tube 13.

Television signals currently transmitted by the broadcasting authorities in Europe contain extra information over and above the picture information and its associated synchronising information. This extra information represents textual and graphical information and associated synchronising and control information. With the addition of suitable circuitry to the television receiver shown in Figure 1, the received textual and graphical information can be selectively stored and then displayed under user control on the tube 13 instead of, or simultaneously with, the received video signal.

The portion of the overall European broadcast television system providing text and graphical information is known as a Level 1 Teletext system (see Characteristics of Teletext Systems. Vol 11, Report 957, CCIR XV Plenary Session Geneva, 1982). Several higher levels have been defined in the same reference which provide for more complex data formats than Level 1, thus allowing for higher resolution graphics and for finer control of the range of colours displayed in the Teletext picture, and allowing for control of the presentation of a mixed broadcast video and Teletext picture.

Teletext information is normally transmitted in timing periods when neither video nor synchronising information is being transmitted. The effect to the viewer is that Teletext information appears to be transmitted simultaneously with video information. There is, however, also a Teletext transmission mode in which the video information is not transmitted in order to permit almost continuous transmission of Teletext information. This mode can be used, for example, for rapid transmission of computer programs or of large volumes of data.

Integrated circuits for implementing Level 1 Teletext functions in a television receiver have been produced by numerous manufacturers, but those most commonly used are designed and manufactured by Philips (trading as Mullard in the U.K.). The first generation of Philips Teletext integrated circuits are described in "LSI Circuits for Teletext an Viewdata - the Lucy Generation. Mullard Technical Publication M81-0001, 1981", while the second generation are described in "Computer Controlled Teletext. J. R. Kinghorn, Electronic Components and Applications, Vol 6, No. 1, p 15, Philips Electronic Components and Material Division, 1984" and in "User Manual, Computer Controlled Teletext. Philips, 1984".

Teletext signals are recovered from the baseband video signal by and stored in a Teletext decoder. The decoder also generates the video signals which cause the Teletext display to appear on the tube 13. Figure 2 shows the organisation of a second generation decoder using Philips components.

Baseband video signals 26 received from the video detector 4 over the line 26 are processed in the video processor 15 (based on component SAA5230 VIP2) in order to detect and recover all Teletext signals. These Teletext signals appear, together with timing waveforms for synchronising purposes, on output lines 27. The video processor 15 also separates the television synchronising signals from the video and Teletext information, applying the synchronising signals to line 28. In the absence of video input on line 26, the video processor generates television synchronising signals on line 28.

Teletext data output in serial form on lines 27 is interrogated by the controller portion of the controller and display generator 16 (based on component SAA5240 EUROCCT). Only that data which the controller has been commanded to accept is recovered and is written to the display memory 23. Commands to the controller are received on a serial control and data bus 25 from a controlling microcomputer 18 whose control program is fixed in read only memory on the microcomputer integrated circuit. Commands from the user are received by the microcomputer either from a local control panel 22 or via an infra-red link 20 and a receiver 19 from a remote control unit 21.

The local or remote control panels 22, 21 can also be arranged to control television receiver functions channel selection, contract, volume, brightness, colour hew and saturation by incorporating extra control programs in the microcomputer 18 and by arranging for

suitable control electronics to be incorporated into the receiver and connected to the microcomputer 18 via the serial control bus 25,29. The control electronics will be described below with reference to Figure 3.

The display portion of the controller and display generator 16 reads data and display formatting information from the memory 23 and generates colour video signals on line 30 in synchronism with the display scan circuits 11, 12 in Fig. 1. These video signals are processed and buffered in the block 17 and then sent over the line 24 to the second input of the video mixer of Figure 1. The block 17 includes a contrast control circuit which receives a control signal from the television control circuits over the line 31.

Figure 3 shows a simplified partial block diagram of a television receiver with the Teletext decoder incorporated. The reference numerals used in Figure 3 correspond with those used in Figures 1 and 2 and it is believed that this block diagram will be clear with little further explanation. Here the television channel selection input to the tuner 1, colour and video mixing controls to the colour decoder and video mixer 8, picture contrast and brightness control to the video amplifier 9 and volume control and muting to the audio amplifier 6 are all generated by the microcomputer in the Teletext decoder and controller module.

Level 3 Teletext has been implemented in a Philips integrated circuit (I.C.) known as EUROM which is described in "User's Manual, SAA5350 European Read-Only Memory (EUROM). Mullard Applicaiton Laboratory, Mitcham, 1983". Whereas the Level 1 Teletext integrated circuit 16, Figure 2 and the second generation integrated circuits mentioned above implement both data acquisition control and data display, the EUROM I.C. implements Level 3 display facilities only. It is recommended by

the manufacturers that data acquisition control be handled at present by using the control portion of the Level 1 circuit. Figure 4 shows the configuration required.

The display controller 37, comprising the EUROM I.C., and its display memory communicate with each other by means of a 16-bit parallel multiplexed address and data bus 35. This bus can also operate in an 8-bit mode, either the least significant 8-bits or the most significant 8-bits being transferred, and in this mode the system control microcomputer 36 accesses other devices on the bus. Commands are transmitted from the microcomputer 36 to the EUROM display controller 37 in 8-bit mode, and data is transferred from the microcomputer 36 to the display memory 39 in 8-bit mode. This display data is retrieved from the Teletext data acquisition circuit 16 on the serial bus 25. The data acquisition circuit 16 selects the data from the data stream on line 27 in response to commands on the same serial bus 25 from the microcomputer 36.

Level 3 Teletext is compatible with Level 1 Teletext in that Level 3 broadcast information can be received by Level 1 circuitry, even though such circuitry cannot display Level 3 information. Level 3 display circuitry can also display Level 1 information.

All of the above described circuitry uses either a completely hard-wired controller, such as the Lucy chip in the case of earlier implementations, or a microcontroller 18, 26 whose program is in read-only memory on the same chip as the microcontroller logic. The user of the system is therefore limited to those functions provided by the system designer and manufacturer.

In accordance with the present invention, there is provided in combination a television receiver including Teletext decoder and display circuitry and a computer, characterised in that the computer is user programmable and comprises a processor which is connected to communicate with the Teletext display circuit and with the display memory of the Teletext circuitry.

The invention in broad terms proposes the replacement of the microcomputer with its programs in ROM by a user programmable computer. The resultant combination offers several important advantages which will now be considered.

When a personal computer is connected to a domestic broadcast television receiver instead of a visual display unit, the quality of the display is generally inferior to that of a purpose built monitor. The reason for this poor resolution is limited bandwidth and synchronisation problems which occur when the digital output of the computer is first modulated onto a carrier and then demodulated in the television receiver. By contrast, Teletext display circuits are able to provide good legibility of alphanumeric information because the incoming information is stored in a local buffer memory and synchronisation is controlled by an internal clock, thereby ensuring greater precision in the positioning of characters on the screen. By enabling the computer output to share the Teletext circuitry, the invention enables a substantial improvement to be achieved in the display quality of the computer.

There is an increase in the amount of software that it transmitted using the Teletext channels. The invention enables such programs and data not only to be received and stored but also edited by the user.

When a television is used as a display for a computer, there is unnecessary duplication of several circuits in the two units. For example, a separate power supply is required for the computer and there is further a need for the computer to incorporate its own display memory and character generator both of which are already present in a receiver designed for reception of Teletext. Thus, in addition to the improvement in performance achieved, as compared with a computer connected to the aerial socket of a television receiver, the invention permits the combined television and personal computer to be manufactured less expensively and the cost need only be little more than the cost of a receiver alone, especially since the functions performed by the prior art Teletext processor may be implemented by programs contained in a read-only memory accessed by the user programmable computer.

Currently available computers can permit sophisticated sounds and even speech to be synthesised but the sound quality is limited by the amplifier and loudspeaker. A further advantage of the incorporation of a computer in a television receiver is that the computer may also now benefit by sharing the use of the sound channel of the television.

A still further advantage of the combination of the invention resides in the fact that the remote control unit provided for the receiver may be used as the keyboard input to the computer. The computer is therefore reduced to a small additional board which does not even require a separate housing and may conveniently be housed within the television cabinet.

When using a large screen television with a computer proximity to the screen can be a problem and by using the infra-red or other link of the remote control unit, the user may operate the computer from a safe distance.

The invention will now be described further, by way of example, with reference to the accompanying drawings, in which :

Figure 1 is a schematic block circuit diagram of a conventional television receiver, as described above,

Figure 2 is a block diagram of the circuits of a conventional receiver concerned with decoding and displaying Teletext information,

Figure 3 is a block diagram of television receiver including a Teletext decoder, only capable of providing low resolution images but in which the computer also serves to generate signals for the control of the operation of the television, such as the control of volume, contrast, brightness and colour,

Figure 4 is a partial block diagram of a Teletext receiver fitted with the Teletext circuitry for achieving high resolution images on the screen,

Figure 5 is a block diagram of a combined television and computer in accordance with the invention, and

Figure 6 is a partial block diagram of a modification of the arrangement shown in Figure 5.

In Figures 5 & 6, blocks described previously with reference to Figures 1 to 4 have all been allocated the same numerals and will not be described again. In essence, the invention replaces the Teletext system control functions of the microcomputer 36 with a user-programmable microprocessor system 44,

Some basic Teletext functions will be provided by means of programs supplied with the system, either in read-only memory 45 or in some other convenient form. Typical functions at this level include selection of pages for acquisition and display, double-height display of top or bottom half of the stored pages, a reveal function to display hidden information, display control display of T.V. picture, or Teletext picture, or both. Some more sophisticated functions which may also be provided are, for example, search for several pages simultaneously, store several pages, and switch rapidly between them.

Other functions which are not specific to broadcast Teletext manipulation will be provided by means of software which makes full use of the display facilities of the EUROM I.C. 37. As with the basic Teletext function control software, this software may be in read-only memory 45 or in some other convenient form, for example, a floppy disc in a disc drive connected to one of the peripheral ports 46. This additional software will provide a range of functions to assist the user to develop application programs. Typical functions allow user programs to plot points, draw lines and shapes, fill enclosed figures with chosen colours and patterns, define and draw characters and geometric shapes, select and modify the colours displayed on the screen via a colour palette table, cause portions of the screen to flash, move all or part of the displayed picture around the screen, and mix together portions of a broadcast or locally generated television picture with the computer generated picture. This class of function is provided in order to make it possible for the user to program the system to display anything that he wishes within the limits of the resolution of the EUROM logic 37.

The hardware of the EUROM I.C. 37 provides for display of 25 lines of either 40 or 80 characters chosen from a large character set and of dot matrix graphics with a

maximum full screen resolution of 240 horizontal by 250 vertical picture elements with a choice of 1 of 16 colours for each picture element, or with a maximum full screen resolution of 480 horizontal by 250 vertical picture elements with a choice of 1 of 4 colours for each picture element.

Other uses for the broadcast Teletext system, either by radio transmission direct from a ground station, or via a satellite, or by wire or fibre optic link, include distribution of computer software and of data bases. The proposed system is fully capable, when suitably programmed, of receiving this information and of making use of it. In particular programs can be stored, executed, and modified, and data bases can also be sorted, searched, and modified.

With the addition of a suitable interface 46, the system can access other computer systems such as, for example, Prestel or similar Viewdata or Videotex services. Basic television system control functions may be provided, but not necessarily by means of programs running in the user-programmable microprocessor 44. Typical of these functions are channel selection, contrast, colour, brightness and volume control, sound muting and system off/on.

The essential feature of this preferred embodiment is that the Teletext display circuitry 37, Teletext page memory now in the common system random access memory 43 and the user-programmable microprocessor 44 are intimately connected in such a way that the user can write programs which interact with the display circuitry 37, display memory 43, and various interfaces 41, 42, 46 and with the programs supplied with the system in order to generate data, collect broadcast Teletext data, manipulate and display any data in the system, and to control the displayed data and the display parameters.

In the embodiment illustrated in Figure 5, the user programmable microprocessor 44 executes programs in read-only memory 45 and in random access memory 43 via the parallel bus 47. The display controller EUROM I.C. 37 also accesses the random-access memory 43 via the parallel bus 47. Incoming Teletext data is received at the Teletext controller 16, which works under command from the microprocessor 44 via the interface 41 and serial bus 25. The commands to the Teletext controller 16 cause it to select and store in its workspace memory 34 those Teletext pages which the user wishes to capture. The stored Teletext data is then retrieved by the microprocessor 44, again via the serial bus 25 and interface 41.

Keyboard input to the microprocessor 44 is from a full alphanumeric keyboard 40 either via an infra-red link 20, the standard remote control receiver 19 and a serial to parallel interface 42, or else via a wired link 48 to one of the peripheral interface ports 46.

An alternative method of interconnection between Teletext controller 16, its workspace memory 34 and the user-programmable microprocessor 44 is shown in Figure 6, although it should be noted that this is much more difficult to realise with present technology. It does, however, have the advantage that the rate at which data can be recovered by the microprocesor is very much higher with the Figure 6 configuration than with the Figure 5 configuration.

In Figure 6, the microprocessor 44 and the Teletext controller 16 have direct access to the workspace memory 34, with control logic 49 arbitrating between the two on a time-shared basis. Teletext data is therefore collected by the microprocessor 44 direct from the workspace memory 34. Commands to the Teletext controller 16 continue to be transmited via the interface 41 and

serial bus 25. It will be noted also that the workspace memory 34 could form part of the main system random access memory 43.

CLAIMS

1. In combination a television receiver including Teletext decoder and display circuitry and a computer, characterised in that the computer is user programmable and comprises a processor which is connected to communicate with the Teletext display circuit and with the display memory of the Teletext circuitry.

2. A combination as claimed in claim 1, wherein the computer is housed within the same cabinet as the television and power for the computer is derived from the power supply circuits of the television.

3. A combination as claimed in claim 1 or 2, wherein the television is provided with a remote control unit the keys of which serve as a means for manual entry of information into the computer.

4. A combination as claimed in any preceding claim, wherein the computer is further connected to supply signals to the audio channel of the television receiver.

5. A combination as claimed in any preceding claim, wherein the computer is further connected to a read-only memory containing a control program for the acquisition storage and display of Teletext data.

6. A combination as claimed in any preceding claim, wherein the computer serves additionally to provide control signals for the television display and sound circuits to control volume, brightness, contrast and colour.

7. A combination as claimed in any preceding claim, wherein the user programmable micro-processor is connected to a parallel data, address and control bus which is further connected directly to the Teletext

display generator, a random access memory and a read-only memory, the Teletext controller being connected to the parallel bus by way of a series-parallel interface, the controller having an independent workspace memory connected thereto by a further parallel bus.

8. A combination as claimed in claim 7, wherein the first parallel bus is further connected to ports for external peripheral units.

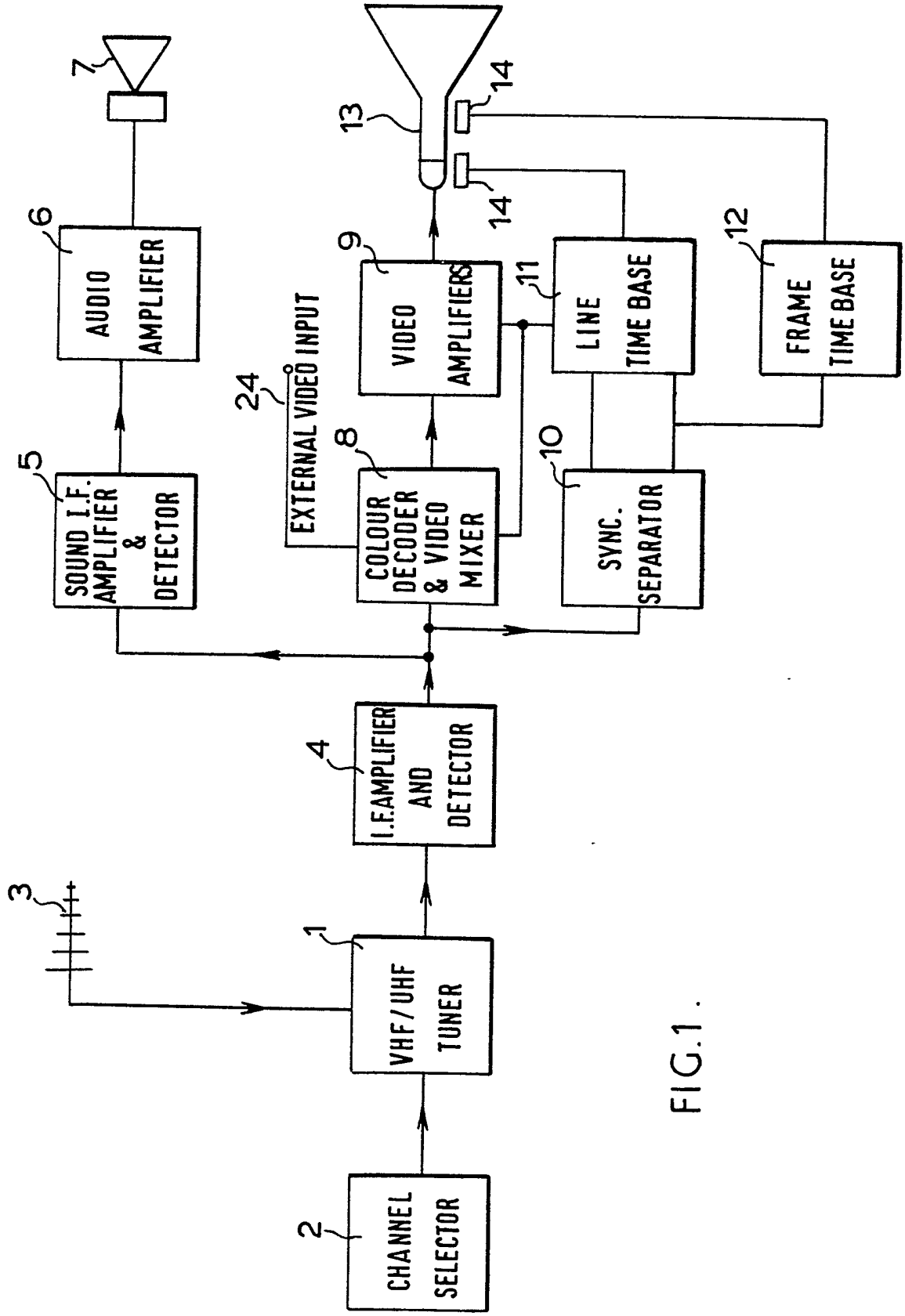


FIG.1.

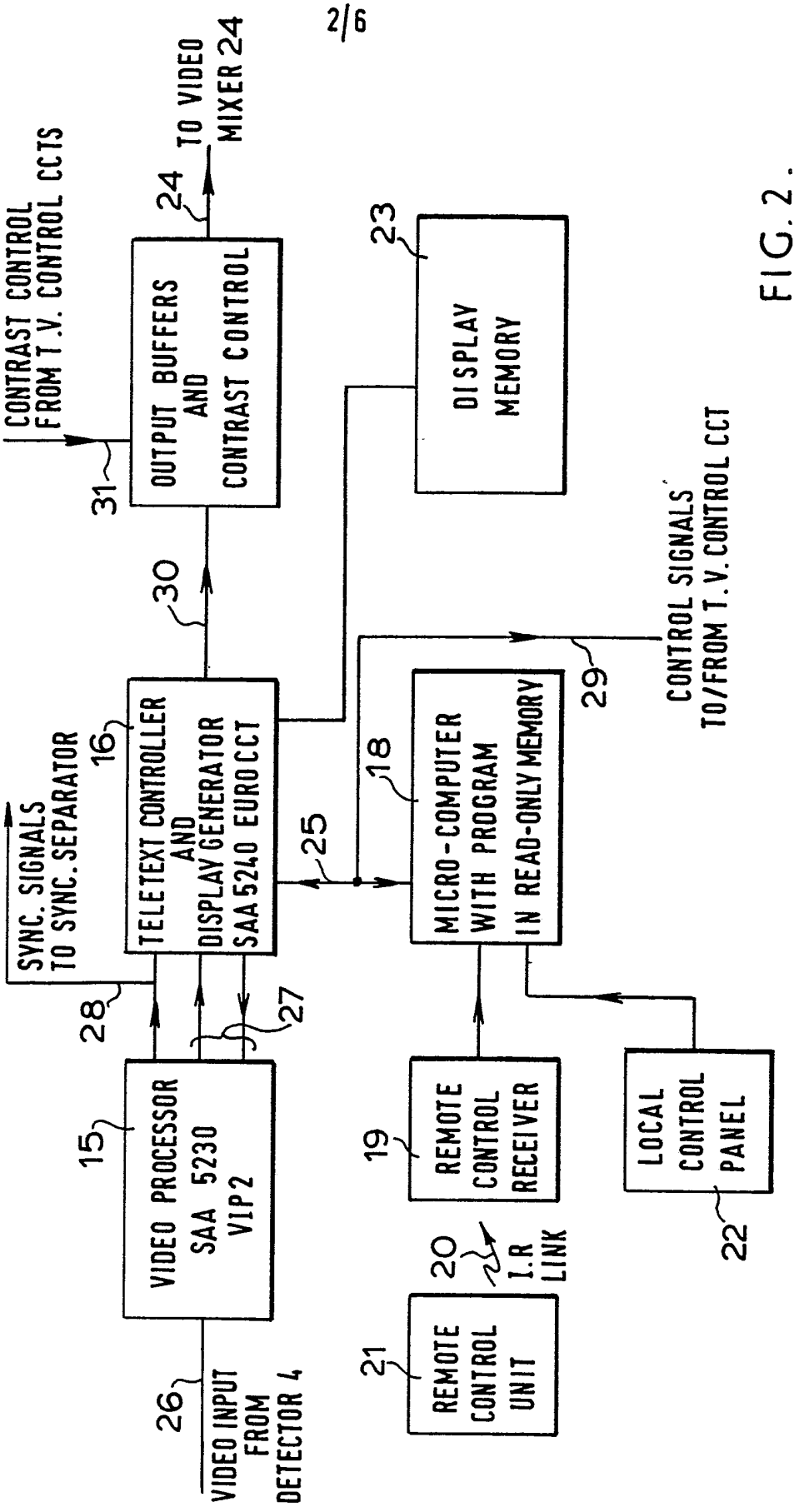


FIG. 2.

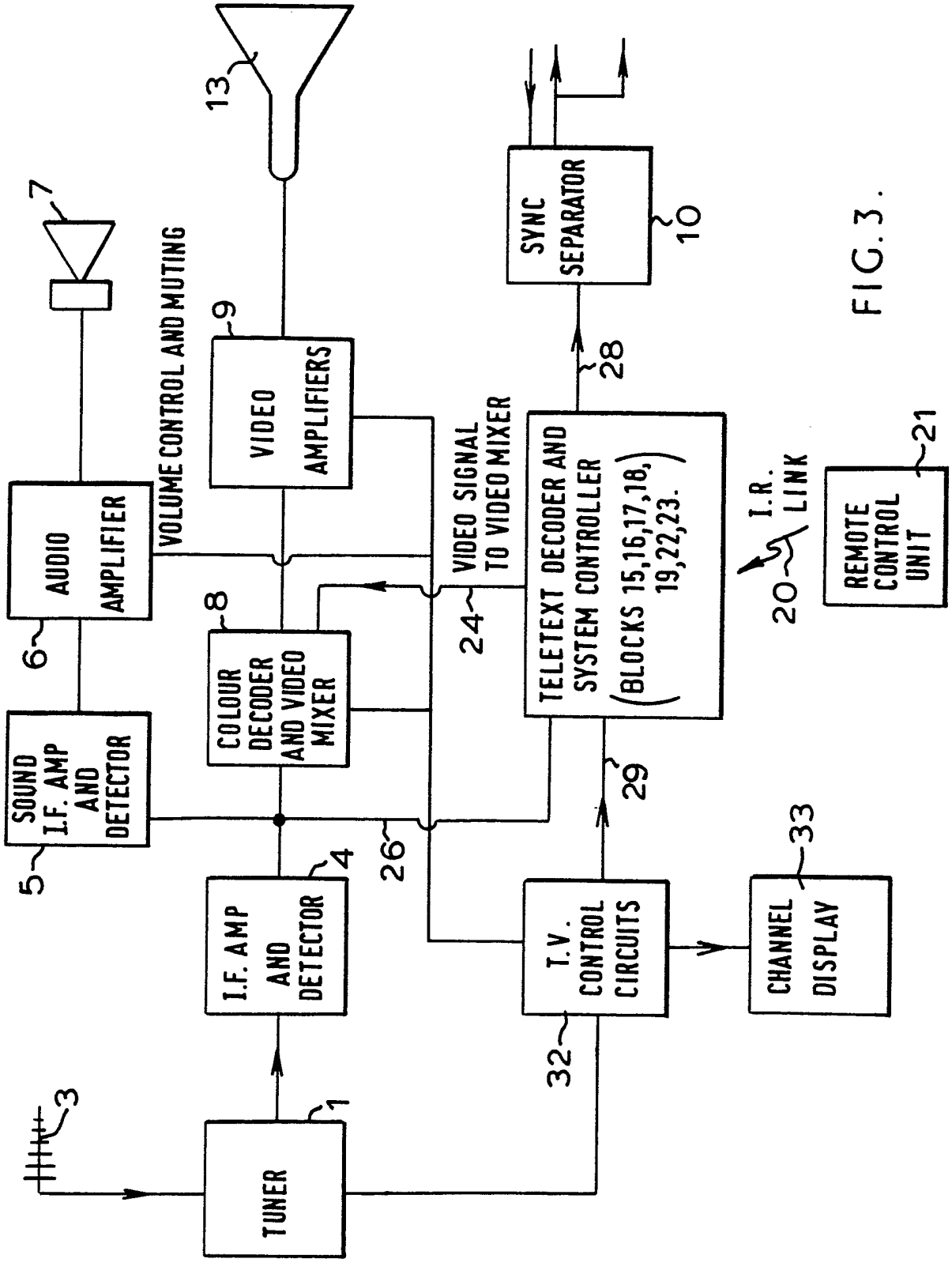


FIG. 3.

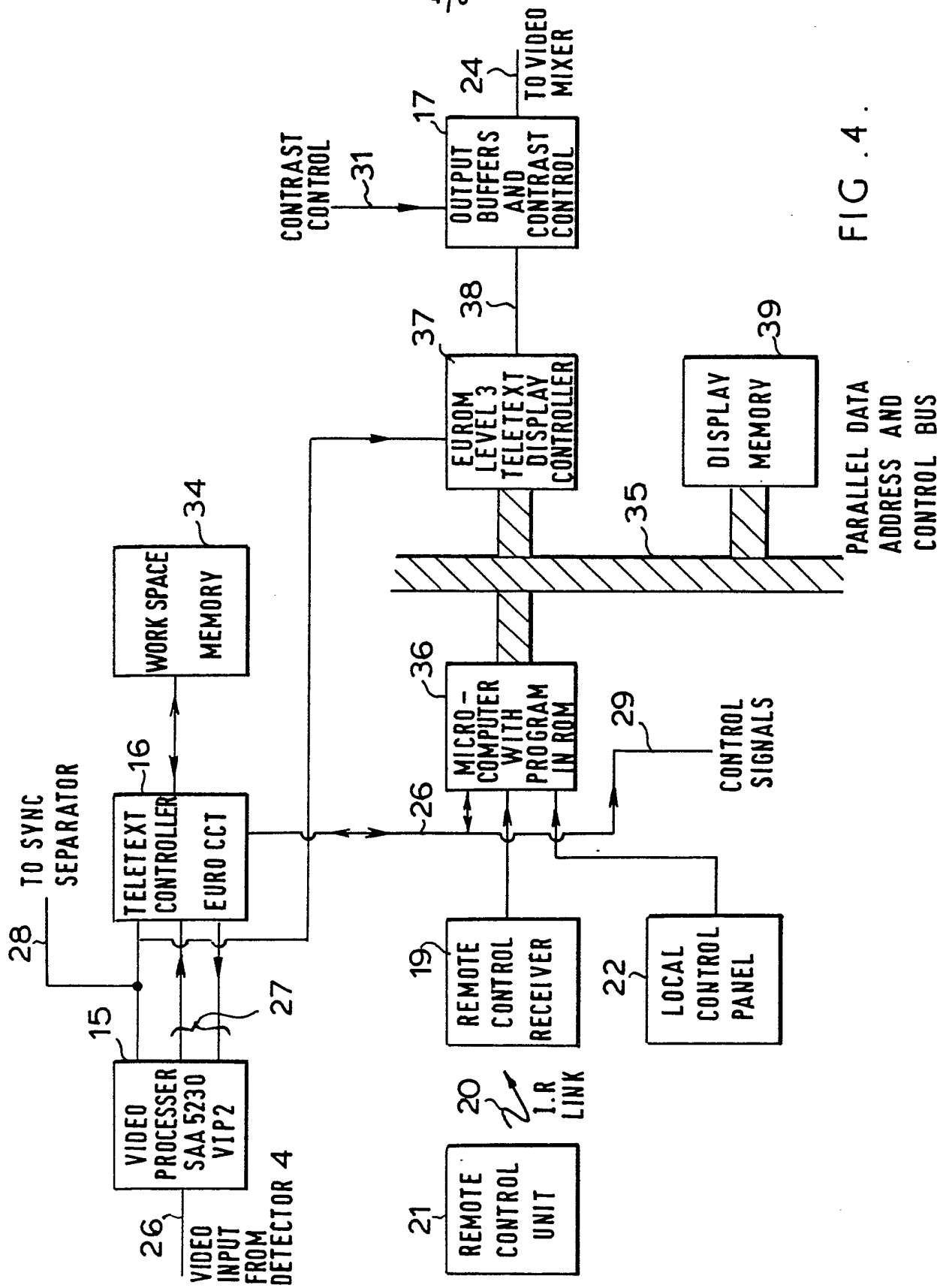


FIG. 4.

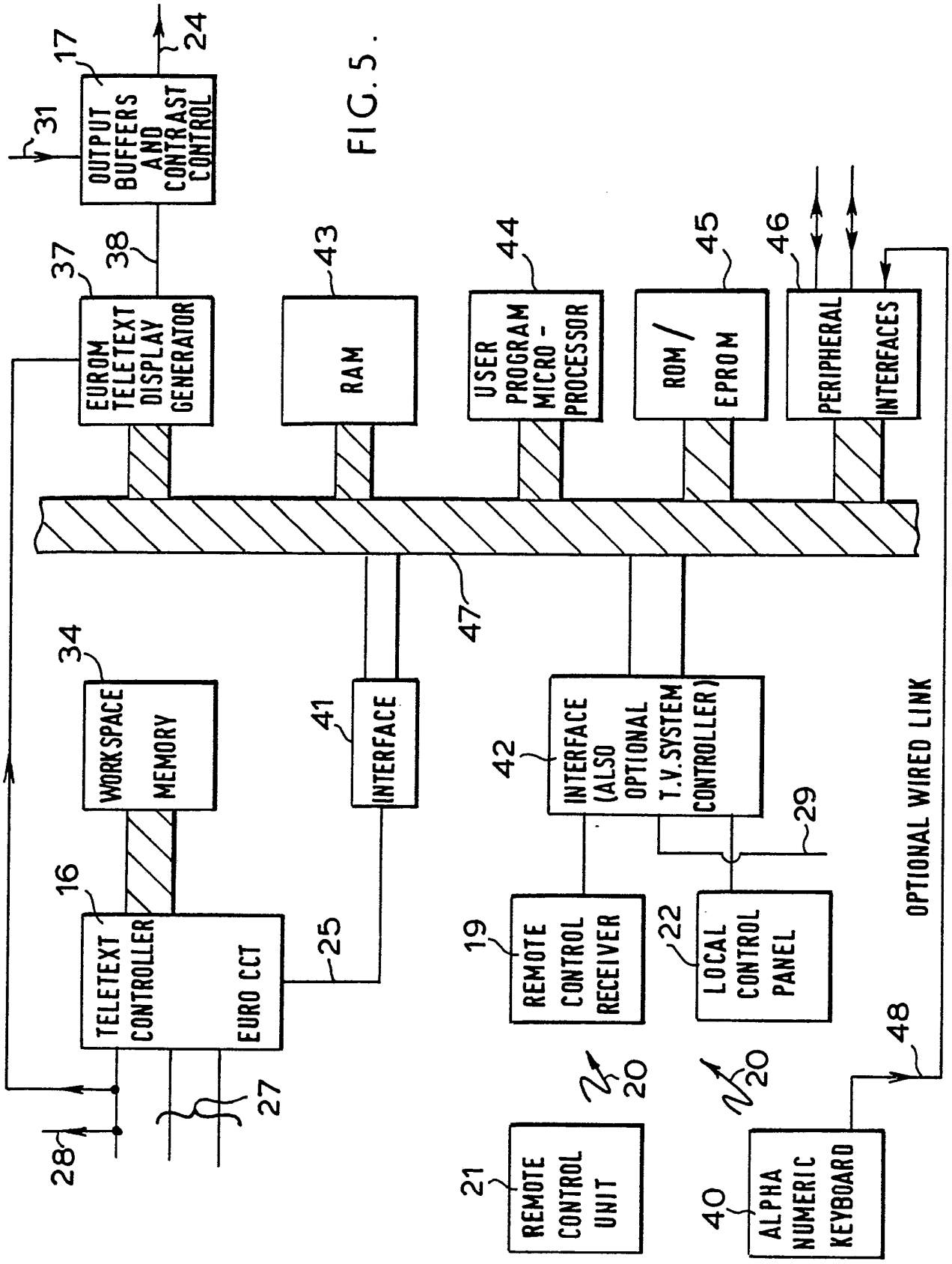
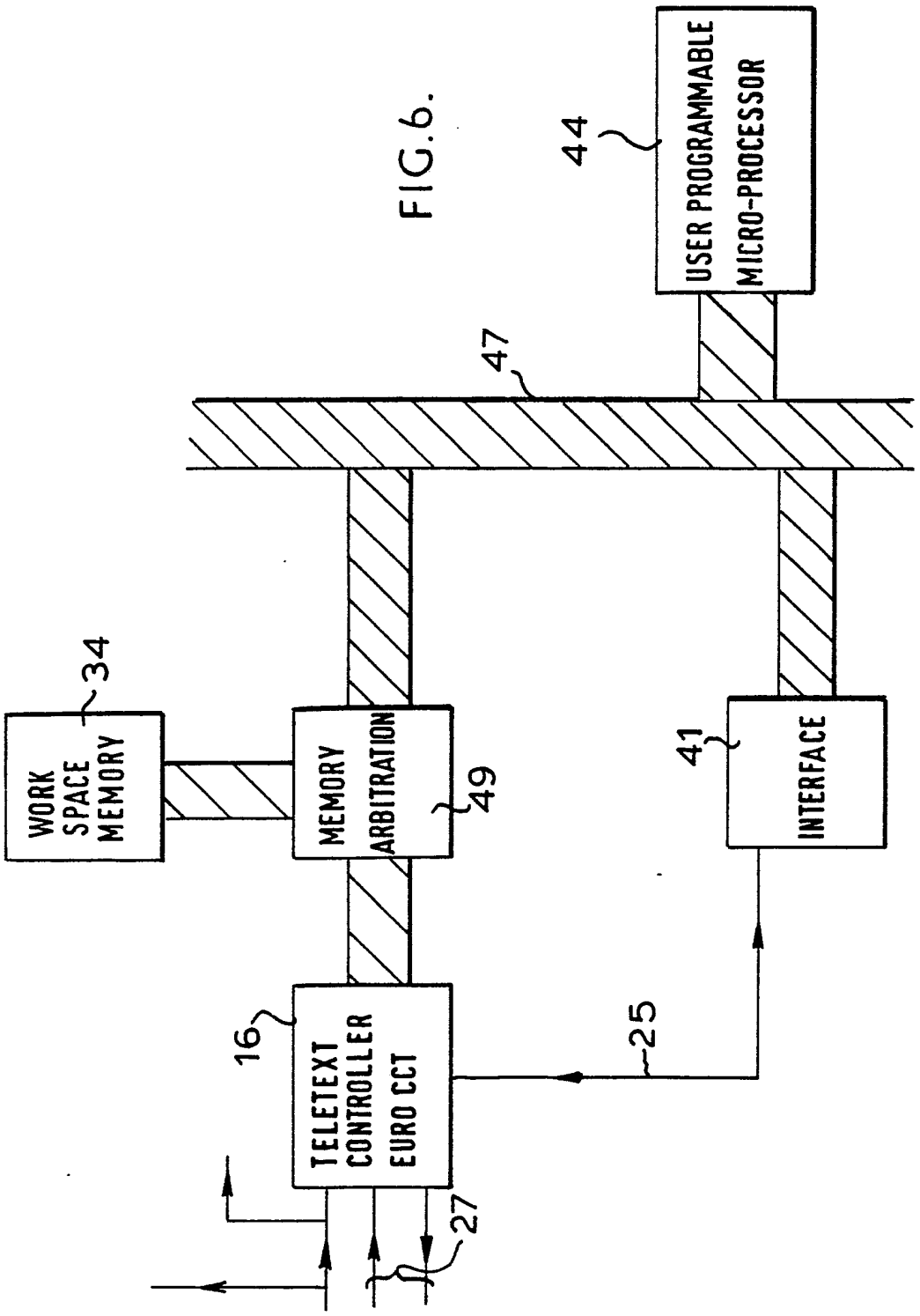


FIG. 5.

FIG.6.



INTERNATIONAL SEARCH REPORT

International Application No PCT/GB 84/00271

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [5]

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC[4]: H 04 N 5/445

II. FIELDS SEARCHED

Minimum Documentation Searched [7]

Classification System	Classification Symbols
IPC[4]	H 04 N 5/44; H 04 N 5/445; H 04 N 9/64

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category *	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No. [13]
X	IEEE Transactions on Consumer Electronics, vol. CE-26, no. 3, August 1980 (New York, US) Hedger et al.: "Tele-software-value added teletext", pages 555-566, see page 556, right-hand column lines 1-40; figure 1	1
X	IEEE Transactions on Consumer Electronics, vol. CE-26, no. 2, May 1980 (New York, US) K. Karstad: "Microprocessor control for color-TV receivers", pages 149-155 see the entire article	1,2,3,4,6
X	Patents Abstracts of Japan, vol. 5, no. 192, 8 December 1981; (E85)(864) & JP, A, 56114490 (Sharp) 9 September 1980, see the entire abstract	1,7,8
A	US, A, 4396941 (K. NISHIMURA)	1
A	EP, A, 0068422 (INDESIT) 5 January 1983	1 ./.

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IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
14th March 1985	24 AVR. 1985
International Searching Authority	Signature of Authorized Officer
EUROPEAN PATENT OFFICE	G.L.M. Kruydenberg

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III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)

Category *	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No
A	IEE Proceedings Section AAI, vol. 129, no. 7, part A, September 1982 (Old Woking, Surrey, GB) J.C. MacKellar et al.: "Television receiver design", pages 493-506, see page 501, paragraph 5.2 - page 505, left-hand column, line 5 --	1
A	Electronics International. vol. 54, no. 16, August 1981 (New York, US) T. Fischer: "Digital VLSI breeds next-generation TV receiver", pages 97-103, see page 102, right-hand column, line 20 - page 103, right-hand column, line 22	1

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON

INTERNATIONAL APPLICATION NO. PCT/GB 84/00271 (SA 7677)

This Annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EDP file on 12/04/85

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US-A- 4396941	02/08/83	JP-A- 54149442	22/11/79
EP-A- 0068422	05/01/83	None	